In the Claims:

1. **Claims 1-10 and 20 (Canceled)**

2. **Kindly add Claims 21-30 as follows:**

11. (Original) A semiconductor device, having an interim reduced-oxygen copper-zinc (Cu-Zn) alloy thin film formed on a copper (Cu) surface by electroplating the Cu surface in a chemical solution, fabricated by a method comprising the steps of:

providing a semiconductor substrate having a Cu surface formed in a via;

providing a chemical solution;

electroplating the Cu surface in the chemical solution, thereby forming an interim Cu-Zn alloy thin film on the Cu surface;

rinsing the interim Cu-Zn alloy thin film in a solvent;

drying the interim Cu-Zn alloy thin film under a gaseous flow;

annealing the interim Cu-Zn alloy thin film formed on the Cu surface, thereby forming an interim reduced-oxygen Cu-Zn alloy thin film;

filling the via with Cu on the interim reduced-oxygen Cu-Zn alloy thin film, thereby forming a Cu-fill;

annealing the Cu-fill, the interim reduced-oxygen Cu-Zn alloy thin film and the Cu surface;

planarizing the Cu-fill, the interim reduced-oxygen Cu-Zn alloy thin film and the Cu surface, thereby forming a dual-inlaid interconnect structure; and

completing formation of the semiconductor device.

12. (Original) A device, as recited in Claim 11,

wherein the chemical solution is nontoxic and aqueous, and

wherein the chemical solution comprises:

at least one zinc (Zn) ion source for providing a plurality of Zn ions;

at least one copper (Cu) ion source for providing a plurality of Cu ions;

at least one complexing agent for complexing the plurality of Cu ions;

at least one pH adjuster;

at least one wetting agent for stabilizing the chemical solution, all being dissolved in a volume of deionized (DI) water.

13. (Original) A device, as recited in Claim 12,

wherein the at least one zinc (Zn) ion source comprises at least one zinc salt selected from a group consisting essentially of zinc acetate ($(CH_3CO_2)_2Zn$), zinc bromide ($ZnBr_2$), zinc carbonate hydroxide ($ZnCO_3 \cdot 2Zn(OH)_2$), zinc dichloride ($ZnCl_2$), zinc citrate ($(O_2CCH_2C(OH)(CO_2)CH_2CO_2)_2Zn_3$), zinc iodide ($ZnI_2$), zinc L-lactate ($(CH_3CH(OH)CO_2)_2Zn$), zinc nitrate ($Zn(NO_3)_2$), zinc stearate ($CH_3(CH_2)_{16}CO_2)_2Zn$), zinc sulfate ($ZnSO_4$), zinc sulfide (ZnS), zinc sulfite ($ZnSO_3$), and their hydrates.

14. (Original) A device, as recited in Claim 12,

wherein the at least one copper (Cu) ion source comprises at least one copper salt selected from a group consisting essentially of copper(I) acetate (CH_3CO_2Cu), copper(II) acetate ($(CH_3CO_2)_2Cu$), copper(I) bromide (CuBr), copper(II) bromide ($CuBr_2$), copper(II) hydroxide ($Cu(OH)_2$), copper(II) hydroxide phosphate ($Cu_2(OH)PO_4$), copper(I) iodide (CuI), copper(II) nitrate hydrate ($(CuNO_3)_2$), copper(II) sulfate ($CuSO_4$), copper(I) sulfide (Cu_2S), copper(II) sulfide (CuS), copper(II) tartrate ($(CH(OH)CO_2)_2Cu$), and their hydrates.

15. (Original) A device, as recited in Claim 11,

wherein said electroplating step comprises using an electroplating apparatus, and wherein said electroplating apparatus comprises:

(a) a cathode-wafer;

(b) an anode;

(c) an electroplating vessel; and

(d) a voltage source.

16. (Original) A device, as recited in Claim 15,

wherein the cathode-wafer comprises the Cu surface, and

wherein the anode comprises at least one material selected from a group consisting essentially of copper (Cu), a copper-platinum alloy (Cu-Pt), titanium (Ti), platinum (Pt), a titanium-platinum alloy (Ti-Pt), anodized copper-zinc alloy (Cu-Zn, i.e., brass), and platinized titanium (Pt/Ti), and platinized copper-zinc (Pt/Cu-Zn, i.e., platinized brass).

17. (Original) A device, as recited in Claim 11,

wherein said semiconductor substrate further comprises a barrier layer formed in the via under said Cu surface, and

wherein the barrier layer comprises at least one material selected from a group consisting essentially of titanium silicon nitride ($Ti_xSi_yN_z$), tantalum nitride (TaN), and tungsten nitride (W_xN_y).

18. (Original) A device, as recited in Claim 17,

wherein said semiconductor substrate further comprises an underlayer formed on the barrier layer,

wherein said underlayer comprises at least one material selected from a group consisting essentially of tin (Sn) and palladium (Pd), and

wherein said Cu surface is formed over said barrier layer and on said underlayer.

19. (Original) A device, as recited in Claim 18,

wherein said underlayer comprises a thickness range of approximately 15 Å to approximately 50 Å,

wherein said barrier layer comprises a thickness range of approximately 10 Å to approximately 30 Å,

wherein said Cu surface comprises a thickness range of approximately 30 Å to approximately 100 Å, and

wherein said interim Cu-Zn alloy thin film comprises a thickness range of approximately 100 Å to approximately 300 Å.

21. (New)A semiconductor device comprising:

a semiconductor substrate having a via;

a Cu surface residing in said via;

an interim reduced-oxygen Cu-Zn alloy thin film residing on said Cu surface;

said interim reduced-oxygen Cu-Zn alloy thin film having a uniform Zn doping distribution across the Cu surface;

a Cu-fill residing on the interim Cu-Zn reduced-oxygen alloy thin film;

said Cu-fill, the interim reduced-oxygen Cu-Zn alloy thin film and the Cu surface being annealed; and

said Cu-fill, the interim reduced-oxygen Cu-Zn alloy thin film and the Cu surface being planarized.

22. (New) A device, as recited in Claim 21,

wherein the interim reduced-oxygen Cu-Zn alloy thin film is formed by electroplating in a nontoxic and aqueous chemical solution, and

wherein the chemical solution comprises:

at least one zinc (Zn) ion source for providing a plurality of Zn ions;

at least one copper (Cu) ion source for providing a plurality of Cu ions;

at least one complexing agent for complexing the plurality of Cu ions;

at least one pH adjuster;

at least one wetting agent for stabilizing the chemical solution, all being dissolved in a volume of deionized (DI) water.

23. (New) A device, as recited in Claim 22,

wherein the at least one zinc (Zn) ion source comprises at least one zinc salt selected from a group consisting essentially of zinc acetate ($(CH_3CO_2)_2Zn$), zinc bromide ($ZnBr_2$), zinc carbonate hydroxide ($ZnCO_3 \cdot 2Zn(OH)_2$), zinc dichloride ($ZnCl_2$), zinc citrate ($(O_2CCH_2C(OH)(CO_2)CH_2CO_2)_2Zn_3$), zinc iodide ($ZnI_2$), zinc L-lactate ($(CH_3CH(OH)CO_2)_2Zn$), zinc nitrate ($Zn(NO_3)_2$), zinc stearate ($CH_3(CH_2)_{16}CO_2)_2Zn$), zinc sulfate ($ZnSO_4$), zinc sulfide (ZnS), zinc sulfite ($ZnSO_3$), and their hydrates.

24. (New) A device, as recited in Claim 22,

wherein the at least one copper (Cu) ion source comprises at least one copper salt selected from a group consisting essentially of copper(I) acetate (CH_3CO_2Cu), copper(II) acetate ($(CH_3CO_2)_2Cu$), copper(I) bromide (CuBr), copper(II) bromide ($CuBr_2$), copper(II) hydroxide ($Cu(OH)_2$), copper(II) hydroxide phosphate ($Cu_2(OH)PO_4$), copper(I) iodide (CuI), copper(II) nitrate hydrate ($(CuNO_3)_2$), copper(II) sulfate ($CuSO_4$), copper(I) sulfide (Cu_2S), copper(II) sulfide (CuS), copper(II) tartrate ($(CH(OH)CO_2)_2Cu$), and their hydrates.

25. (New) A device, as recited in Claim 22,

wherein said electroplating comprises using an electroplating apparatus, and

wherein said electroplating apparatus comprises:

(a) a cathode-wafer;

(b) an anode;

(c) an electroplating vessel; and

(d) a voltage source.

26. (New) A device, as recited in Claim 25,

wherein the cathode-wafer comprises the Cu surface, and

wherein the anode comprises at least one material selected from a group consisting essentially of copper (Cu), a copper-platinum alloy (Cu-Pt), titanium (Ti), platinum (Pt), a titanium-platinum alloy (Ti-Pt), anodized copper-zinc alloy (Cu-Zn, i.e., brass), and platinized titanium (Pt/Ti), and platinized copper-zinc (Pt/Cu-Zn, i.e., platinized brass).

27. (New) A device, as recited in Claim 21,

wherein said semiconductor substrate further comprises a barrier layer formed in the via under said Cu surface, and

wherein the barrier layer comprises at least one material selected from a group consisting essentially of titanium silicon nitride ($Ti_xSi_yN_z$), tantalum nitride (TaN), and tungsten nitride (W_xN_y).

28. (New) A device, as recited in Claim 27,

wherein said semiconductor substrate further comprises an underlayer formed on the barrier layer,

wherein said underlayer comprises at least one material selected from a group consisting essentially of tin (Sn) and palladium (Pd),

wherein said Cu surface is formed over said barrier layer and on said underlayer, and

wherein said Cu surface is electroless Cu.

29. (New) A device, as recited in Claim 28,

wherein said underlayer comprises a thickness range of approximately 15 Å to approximately 50 Å,

wherein said barrier layer comprises a thickness range of approximately 10 Å to approximately 30 Å,

wherein said Cu surface comprises a thickness range of approximately 30 Å to approximately 100 Å, and

wherein said interim Cu-Zn alloy thin film comprises a thickness range of approximately 100 Å to approximately 300 Å.

30. (New) A semiconductor device comprising:

a semiconductor substrate having a via; and

a dual-inlaid interconnect structure formed and disposed in said via, said interconnect structure comprising:

at least one annealed, conformal Cu surface formed in said via;

at least one annealed, electroplated, conformal interim reduced-oxygen Cu-Zn alloy thin film having a uniform Zn distribution disposed on the at least one Cu surface; and

at least one annealed, conformal Cu-fill disposed on said at least one annealed, electroplated, conformal interim reduced-oxygen Cu-Zn alloy thin film.